

XIV.—ADDITIONS TO THE ANTHOZOA AND HYDROZOA OF THE
BERMUDAS. BY A. E. VERRILL.

ANTHOZOA.

Madreporaria.

A partial list of the corals collected at Bermuda (9 species) was published by J. M. Jones* in 1869. The identifications of his species were mostly made by the present writer, but his collection was very incomplete, and errors were made in printing the list. Another list (10 species) was also prepared by the writer for Prof. J. D. Dana† and published in 1872. Mr. A. Heilprin‡ also published a list of the Bermuda corals in 1889. His list included 19 species, of which I consider eight as spurious or mere varieties. The most extended list was prepared by J. J. Quelch for the Narrative of the Voyage of the Challenger (vol. i, part i, p. 146, foot note, 1885). This list included 23 species, but several of the six species of *Isophyllia* admitted by Quelch are scarcely more than individual variations of one species, not even worthy to be called varieties. Probably not more than two actual species of *Isophyllia* exist at Bermuda, and even these may eventually be united into one very variable species. I could detect no constant differences in the soft parts after a careful study of hundreds of living specimens, including all the varieties, though the color varies extremely, ranging through bright green, olive-green, gray, lavender, etc., all these colors being often found on a single example, distributed in regular patterns, or in irregular blotches, and generally they are varied with spots or blotches of flake-white.§ In some cases the color may be clear emerald-green, in others nearly clear lavender or gray, but some large examples were found that were half uniform green and half lavender without blotchings, the two colors being defined by a median plane. Nor

* Cont. to the Nat. Hist. of the Bermudas, Trans. Nova Scotia Inst., 1869. Reprinted in Visitors' Guide to Bermuda, p. 145, 1876.

† Corals and Coral Islands, Ed. I, 1872; Ed. II, p. 114, 1874.

‡ The Bermuda Islands, Philad., 1889.

§ Some specimens were phosphorescent at night and this property seemed to be related to the white pigment.

do these colors depend to any great extent on the station, for in some cases all these variations may be found in one place. But those specimens found scattered in shallow water on bottoms of white shell-sand were usually gray, or pale lavender mottled with gray, though the hard parts do not differ from the darker colored ones. One of the commonest forms at Bermuda was named *Mussa fragilis* by Dana (Zoöph., p. 145, 1846). The type of this, from Bermuda, is still in the Museum of Yale University. This, which is the common more delicate form, should therefore bear the name *Isophyllia fragilis*. It is possible that the coarser *I. dipsacea* (D.) is only a variation of the same species, due to more vigorous growth.

Quelch also recognized seven species of *Oculina* from Bermuda, which is doubtless too many, for all the species are variable in form, the degree of elevation of the corallites, etc. Apparently all the Bermuda forms of *Oculina* can be reduced to four species. He also recorded two species of *Astræa* (*A. ananas* and *A. coarctata*). We found these two forms common in tide-pools, but consider them merely variations of one species (*A. ananas*).

So, likewise, we consider *Diploria Stokesii*, listed by Heilprin, as a mere variation of *D. cerebriformis*, with the ridges wider and more deeply grooved than usual. It is a common form.

Thus, at least eight nominal species should be eliminated from Quelch's list, leaving but 15 species. On the other hand he omitted one of the commonest species (*Porites astræoides*), recorded in other lists,* and *Siderastræa radians*, recorded by Jones. I have now to add three additional species of true reef corals, two of which (*Orbicella annularis* and *O. cavernosa*) are not uncommon and grow to large sizes. Thus the number of true anthozoan corals now known is about 20.

All these corals, except the *Plesiastrea*, herein described as new, are common West Indian and Florida species. The coral-fauna of Bermuda differs chiefly from that of the Florida reefs and the Bahamas in the absence of certain prominent and well known genera and species characteristic of the latter, especially the genera *Madrepora*, *Manicina*, *Colpophyllia*, *Eusmilia*, *Dichocenia*, *Dendrogyra*, *Cladocora*, and the two very common species, *Meandrina clivosa* and *Agaricia agaricites*. Possibly some of these may yet be discovered at Bermuda, but if found there at all they must be very local and rare, for the Bermuda corals have been extensively collected.

* See Richard Rathbun, Proc. U. S. Nat. Mus., 1887, p. 354.

Additional species of Bermuda Corals.

Orbicella annularis Dana.

Madrepora annularis Ellis and Sol., 1786.

Astræa annularis Lam., Anim. sans Vert., ii, 1816.

Heliastrea annularis Edw. and Haime, Corall., ii, 1849.

Astræa (Orbicella) annularis Dana, Zoöph., p. 214, pl. 10, fig. 6, 1846.

Orbicella annularis Verrill, Bull. Mus. Comp. Zoöl., I, p. 48, 1864. Pourtales, in Agassiz Rep. on Florida Reefs, Mem. Mus. Comp. Zoöl., vii, part I, pl. iv, figs. 1-10, 1880.

I have examined several large and characteristic examples of this species from the outer reefs of the Bermudas and also from the reefs in Great Sound, etc. Good specimens are in the American Museum, New York, and in the museum of the University of New York. The latter were obtained by Prof. Bristol's party. We obtained but one example.

The color in life is dull yellow. It does not differ from the Florida form.

Orbicella cavernosa (Esp.) Dana.

Madrepora cavernosa Esper., 1797.

Astræa argus Lam., Anim. sans Vert., ii, 1816.

Astræa (Orbicella) argus Dana, Zoöph., p. 207, pl. x, figs. 1a, 1b, 1846.

Heliastrea cavernosa Edw. and Haime, Corall., ii, 1857.

Orbicella cavernosa Verrill, Bull. Mus. Comp. Zoöl., I, p. 47, 1864.

The only specimen studied by me is a large hemispherical mass, in excellent condition, which formed part of the Bermuda exhibit, sent by the Governor of Bermuda to the Centennial Exposition at Philadelphia, in 1876, and afterwards presented to the U. S. National Museum. It is said to be not uncommon on the outer reefs near North Rocks.

Plesiastrea Goodei, sp. nov.

PLATE LXVII. FIGURE 1.

Coral solid, massive, hemispherical, calices circular, not very deep, pretty regularly arranged, near together, with their margins a little prominent and thickened. Septa prominent, nearly entire, usually 24, of which 12 are broad, reaching the columella, and alternate with 12 much narrower ones that extend only one-third the distance. The larger septa are vertical within, distinctly thickened distally, and bear thickened paliform lobes at the inner edge, close to the columella.

Columella solid, rather prominent, convex, circular or elliptical.

Diameter of coral about 9 inches (225^{mm}); of calices, 2.6^{mm} to 3^{mm}.

A single specimen of this fine species was collected at Bermuda by Mr. G. Brown Goode, in 1876.

Madracis decactis (Lyman, 1857), Verrill, 1864.

This species often grows in irregular masses composed of rounded nodules, easily broken apart. Although the coral has but ten equal septa, the animal has 20 regular but obtuse tentacles, in two cycles, differing a little in size and position (Pl. lxvii, fig. 10). The color, in life, is light orange-yellow or ochre-color. It is not rare.

Siderastræa siderea (Ellis and Sol.) Blainv.

This is very common in shallow water, both on the reefs and in the sounds, and it often grows in places where no other corals grow, owing to the turbidity of the water. It sometimes forms hemispheres over a foot across.

The figures of the polyps of this genus given by Agassiz (Florida Reefs) are not correct in representing the tentacles as three-lobed. They are simple, short, clavate or subcapitate, those of the different cycles quite unequal; a pair of small ones, each side of the base of a larger one, gave rise to the error in the figures drawn for Agassiz.

Figures of the animals of this and many of the other corals have been made for the final report on our Bermuda collection.

ACTINARIA.

A valuable paper on the Bermuda actinians was published by Prof. J. P. McMurich in 1888-1887, with studies of the internal structure of most of the species. His list included five actinians* and five Zoanthidæ. One or two additional species were recorded from the Challenger Expedition.†

* Proc. Acad. Nat. Sci., Philad., 1888, and reprinted in Heilprin's *The Bermuda Islands*, pp. 105-135, pl. 10, 11, 1889. Of the species enumerated "*Aiptasia* sp." is probably *A. tagetes*; *Oulactis fasciculata* is *Asteractis flosculifera* (Les.) Verrill, Amer. Journ. Sci., vii, p. 45, 1899 (non McMur.); *Phymactis crucifer* is *Epicystis crucifera* (Les.) Ehr.; Verrill, op. cit., vi, p. 496, 1898. The latter is a very large, handsome, pink and white species, with thickened, white transverse ridges on the inner side of the tentacles. It lives deeply buried in the crevices of the reefs.

† *Ilyanthopsis longifilis* Hertw., Rep. Zoöl. Voy. Challenger, xxvi, p. 13, pl. ii, fig. 12, was described from the Bermuda reefs.

It is shaped like *Aiptasia*, with a smooth column and collar; no acontia; 160 long tentacles and the same number of perfect mesenteries; a pedal disk; no sphincter muscle. Evidently allied to *Anthea* or *Anemonia*.

The most abundant species is *Condylactis passiflora* D. and M., which is often a foot across. Its body is red; tentacles very long, gray, tipped with pink or purple.

Our party added several interesting species to the list, some of which have already been recorded by me in the American Journ. Science.* The Zoanthidæ of our collection have not yet been fully studied, but they probably include one or two species, not included here, new to the fauna. The following are the species not definitely included in McMurrich's list. (See foot note above.)

Additional Actinaria.

Lebrunia Danæ (D. and M.) Verrill.

Oulactis Danæ Duch. and Mich., Corall. Antill., p. 47, pl. vii, fig. 10, 1860.

Lebrunea neglecta Duerden, Actin. Jamaica, p. 456, 1898 (*non* D. and M.).

Lebrunia Danæ Verrill, Amer. Journ. Sci., vii, p. 46, fig. 15, p. 48, 1899.

PLATE LXVII. FIGURE 3. PLATE LXIX. FIGURE 1.*

Several large specimens, up to 8 inches in diameter, were found imbedded to the tentacles in crevices of the reefs. The arborescently branched, green, gill-like fronds (fig. 3) are very large and covered with many round, blue acrorhagi.

Actinotryx Sancti-Thomæ Duch. and Mich.

Corall. Antill., p. 45, pl. vii, fig. 2, 1860. Andres (*Actinothryx*), 1883. Duerden, Jamaican Actinaria, part ii, p. 148, pl. x, figs. 3-6, pl. xi, figs. 3, 4, pl. xii, fig. 3, 1900.

Rhodactis Sancti-Thomæ McMurrich, Actin. Bahama Is., p. 42, pl. i, fig. 9, pl. iv, figs. 2, 3, 1889.

PLATE LXVIII. FIGURE 5.

Very common on the reefs, living exposed and usually gregariously, those in each group generally of the same color, and probably produced by fission from one parent stalk. The body is usually pear-shaped or top-shaped with a wide disk, covered with radial rows of small, lobed actinobranchs, diversified in color. Marginal tentacles are very small, unequal. It secretes a large quantity of mucus when irritated. The color is variable, usually brownish or purplish exteriorly. The base is smaller than the disk, often lobate, and very firmly adherent. The disk is but little contractile and not retractile.

* Vols. vi and vii. Brief Cont. to Zoöl., Nos. lviii-lxii, 1898, 1899.

Ricordea florida (D. and M.).

? *Ricordea florida* Duch. and Mich., Corall. Antill., p. 42, pl. vi, fig. 11, 1860.
Duerden, op. cit., p. 156, pl. x, fig. 7, pl. xi, figs. 5, 6, pl. xii, figs. 1, 2, pl. xiii, fig. 1, 1900.

Heteranthus floridus McMurrich, op. cit., p. 47, pl. i, fig. 10, pl. iv, figs. 4, 5, 1889.

Habits and colors nearly the same as of the last.

It is possible that this is not the true *florida* of D. and M., but it appears to be the species described under this name by McMurrich. Duerden's species agrees better with the type of D. and M.

Epicystis osculifera (Les.) Ver.

Actinia osculifera Leseur, Journ. Philad. Acad. Sci., i, p. 175, 1817.

This species or variety scarcely differs from *E. crucifera*, except in lacking the transverse white ridges on the tentacles, characteristic of the latter. The colors of the two forms are similar and are variable in the same way in each.

Leseur's description seems to apply better to this than to any other known West Indian form. Duerden (op. cit., 1900, p. 139), considers this only a variety of *E. crucifera*.

Bunodactis stelloides (McMur.) Verrill.

Aulactinia stelloides McMurrich, Actinaria of Bahama Is., p. 28, pl. i, figs 5, 6, pl. iii, figs. 8-10, 1889.

Aulactinia stella Duerden, Journ. Inst. Jam., ii, p. 454, 1898 (*non* Verrill sp.).

Bunodella stelloides Verrill, Amer. Journ. Sci., vii, p. 43, Jan., 1898.

Bunodactis stelloides Verrill, op. cit., vii, p. 146, foot note, 1899.

Common under stones near low-tide mark.

SAGARTIADÆ.

Aiptasia annulata (Les.) Andres.

Actinia annulata Leseur, Journ. Philad. Acad., i, p. 172, 1817.

Aiptasia annulata Andres, Actinies, 1883. McMurrich, Actinaria Bahama Is., p. 7, pl. i, fig. 1, pl. iii, fig. 1, 1889.

PLATE LXVIII. FIGURE 3.

This species is not uncommon in the crevices of the reefs at and below low-tide. The largest examples were 8 inches or more in diameter when fully expanded and had several hundreds of tentacles. The color is generally light green with subspiral, raised, white annulations on the tentacles, which persist in preserved specimens.

Aiptasia tagetes (D. and M.) Andres.

Bartholomea tagetes Duch. and Mich., Supl. Corall. Antill., p. 39, pl. vi, fig. 16, 1866.

Aiptasia tagetes Andres, Actinies, 1883. McMurrich, Actin. Bahama Is., p. 12.

PLATE LXVII. FIGURE 2.

Common at low-tide in crevices of the reefs. Usually green, or dark olive-green, with white specks.

Phellia rufa Verrill, sp. nov.

? *Phellia clavata* Duerden, Actin. Jamaica, p. 459, 1898 (*non* D. and Mich.*).

PLATE LXVIII. FIGURE 2.

Column rather slender, usually cylindrical or nearly so, but often somewhat hour-glass-shaped; in expansion often three or four times as high as broad, the capitulum forming about one-fourth the height. Scapus covered with a thick, firmly adherent, tough coat of sand, etc., its upper edge slightly free and irregularly denticulated. Tentacles 36 to 48, in the larger examples, about as long as the diameter of the column or rather longer, the inner ones somewhat longer than the others, but not abruptly so, regularly tapered, subacute.

Color of scapus, under the sandy coat, dull brown; capitulum light rosy red to brick-red and flesh-color, translucent; tentacles variable, most often light terra-cotta red, or salmon-red, sometimes bright red, broadly tipped with reddish brown, and crossed by two or three broad, V-shaped or W-shaped reddish-brown bands, and with an elongated spot of the same color on each side of the base; disk similar to the tentacles in color, variegated with brown and flake-white spots, radially arranged.

Height of largest, 20 to 32^{mm}; diameter, 8 to 12^{mm} in expansion.

Common under and in crevices of stones and dead corals, just below low-tide mark (2 to 6 feet).

This agrees pretty closely with the Jamaican species described as *Phellia clavata* by Duerden, but not with the original account of that species.

* The species described by Duch. and Mich. has the following synonymy:

Phellia Americana Verrill, Proc. Essex Inst., v, p. 327 [13].

Paractis clavata Duch. and Mich., Corall. Antilles, p. 40, pl. vi, figs. 7, 8, 1860 (*non Phellia clavata* Stimp., sp., 1855; Verrill, op. cit., iv, 1865, and vol. vi, pl. i, figs. 3-3b, 1869; *nec Phellia clavata* Duerden, Actinaria around Jamaica, Journ. Inst. Jamaica, ii, p. 459, 1898).

Capnea clavata Duch. and Mich., Supl., p. 33, 1866.

ANTHEADÆ.

Actinoides pallida (Duch. and Mich.) Duerden.

Anthopleura pallida Duch. and Mich., Corall. Antill., Supl., p. 126, 1866.

Actinoides pallida Duerden, Actin. around Jamaica, p. 453, 1898.

PLATE LXVIII. FIGURE 4.

This small species has vertical rows of verrucæ, only on the upper part of the column, decreasing downward, to which bits of shells were firmly adherent; usually there are about six in the larger rows; the upper one is more prominent and somewhat like an acrorhagus. It can usually be recognized by the chain of round or elliptical flake-white spots along the inner surface of the tentacles, bordered externally on each side by a narrow dark olive-green or brown line; some of the spots may touch each other, but they are mostly a little apart and united by a white line, while the dark lines are continuous and persist in preserved specimens after all other colors have faded.

The disk is variegated with green, brown, gray, and flake-white, the white being in the form of 12 or 24 squarish or oblong radial spots in front of the bases of the inner tentacles, and edged with brown radial lines; the lips are either green or white.

Not uncommon under stones at low-tide near Bailey Bay.

Actinia Bermudensis Verrill, Amer. Journ. Sci., vi, p. 495, 1898.

? *Diplactis Bermudensis* McMurrich, in The Bermuda Is., p. 116, pl. 10, figs. 4, 6, pl. 11, figs. 1, 2, 1889.

PLATE LXVII. FIGURE 7.

This is a common red species with a circle of large, round, blue acrorhagi close to the tentacular margin. Occasionally brownish yellow or rust-yellow specimens occur (*var. ferruginea* V.).

Prof. McMurrich has suggested (in letter) that it may prove to be the same as his *Diplactis*, the latter having been described from badly preserved specimens. If so his description certainly does not apply well to this species, which is a typical *Actinia*.

Common under stones at and above low-tide mark.

ALICIINÆ.

Bunodeopsis globulifera, sp. nov.

? *Viatrix globulifera* Duch. and Mich., Corall. Antill., p. 44, pl. vi, figs. 15, 16, 1860.

Verrill, Amer. Journ. Sci., vii, p. 146, fig. 20, 1899.

Bunodeopsis, sp. nov., Duerden, Actin. Jamaica, Journ. Inst. Jamaica, ii, p. 456.

PLATE LXVII. FIGURE 4.

Column broad below, narrowed above; in the least contracted specimens the upper part is tapered to the tentacles and nearly free of tubercles; in others the column is short and covered with tubercles throughout, the naked part being concealed. The tubercles are smooth, rounded, and variable in size and number, larger and smaller ones are mingled together, but in general the lower ones are the larger. They are often very numerous over the lower half of the column and closely crowded. They are present in considerable number in specimens only 2^{mm} in diameter of column, but in such specimens they are mostly near the base. The limbus is strongly crenulated and lobed.

Tentacles, in full expansion, very long and slender, three or four times the diameter of the body; but they can contract to a much thicker, tapered form, about twice the diameter of the disk. They vary in number from 18 to 36, in the examples studied. Usually the number increases two at a time, for examples with 18, 20, 22, 24, and 26 tentacles were found. The twelve inner ones are longer than the others, and two rudimentary ones, just appearing, may often be found. In one case a forked tentacle was noticed. The disk is often nearly flat, but in many it protrudes in a conical form. The mouth is small, with two feeble siphonoglyphs.

Color in life yellowish green, often with dark brown streaks; vesicles yellowish brown. The largest examples are about 15^{mm} high and 8^{mm} broad at base.

Only a single example of this curious species was obtained by us, but a considerable number were collected by Prof. Bristol's party in 1898, which he has kindly loaned to me for study.

It lives attached to algæ in shallow water.

Mr. Duerden informs me that this is doubtless identical with his supposed new species. At first I thought that it would prove to be the adult of the long-sought *Viatrix globulifera*, but if so the latter was badly figured, for its vesicles are represented as close to the bases of the tentacles instead of confined to the lower part of the column. Therefore it seems best to consider it a new species.

EDWARDSIADÆ.

A species resembling an *Edwardsia* is contained in our collection, but it did not expand fully in life.

A specimen dredged in Flatt's Inlet, in 6 to 8 feet, sand, was reddish brown on the scapus, but it did not expose the tentacles. It has 8 fertile and muscular mesenteries with several pairs of small imperfect ones.

It needs to be studied more carefully by serial sections.

ZOANTHIDÆ.

Several species of Zoanthidæ have been described from Bermuda, and some additional forms were obtained by our party.

McMurrich, in 1889, described the five following species, all of which are, apparently, in our collection. His descriptions and figures are largely anatomical and histological.

Zoanthus flos-marinus (non Duch. and Mich.) = *Z. proteus* Ver. = ? *Z. Danæ* Hert. (non Verrill).

Mammillifera tuberculata (Gray) = *Isaurus tuberculatus* Gray. McMurr., 1896; Duerden, 1898.

Corticifera ocellata (non Ellis and Sol.) = *Palythoa grandiflora* Ver., sp. nov.

C. glareola (non Les., 1817) = *Palythoa mammosa* (Ellis and Sol.) = *C. lutea* Hert. (non Quoy and Gaim.) = *P. mammosa* Duerden, 1898.

Gemmaria Rusei (*Rusei* by error, non Duch. and Mich.) = *Parapalythoa Heilprini* Ver., sp. nov.

Hertwig (Rep. Voy. Chall., 1888) described *Zoanthus Danæ*? (non Verrill), and *Corticifera lutea* (non Quoy and Gaim.) The former is perhaps our *Z. proteus*; the latter is our *Palythoa mammosa*.

Additional Species.

Parazoanthus parasiticus (D. and M.).

Zoanthus parasiticus Duch. and Mich., Corall. Antill., p. 50, pl. viii, figs. 3, 4, 1860.

This minute species is frequently found parasitic on the tubular sponge (*Tuba* or *Spinoseella vaginalis*). Only the disk shows at the surface of the sponge. When dried they appear as small, circular, about 12-rayed, stellate, and mostly separated spots, 1.5 to 2^{mm} in diameter, more or less scattered over the surface.

A variety or distinct species, with disks up to 3^{mm} in diameter, occurs, more closely grouped, on a sponge of the genus *Hircina*.

Zoanthus sociatus Les., 1817.

Zoanthus sociatus McMurrich, Actin. Bahama Is., p. 62, pl. ii, fig. 3; pl. iv, figs. 15-18, 1889.

?*Zoanthus flos-marinus* Duerden, Jamaican Actin., part i, p. 339, pl. xviiA, fig. 2, pl. xviiiA, fig. 2, 1898 (*non* Duch. and Mich.).

Several specimens were obtained that seem to agree with this species as described by McMurrich, from the Bahamas, and with the *Z. flos-marinus* of Duerden. The latter has much smaller polyps than the original type of Duch. and Mich., and differs in form, color, and number of tentacles. (See p. 566, below.)

Zoanthus proteus, sp. nov.

?*Zoanthus Danæ* Hertwig (*non* Verrill).

Zoanthus flos-marinus McMurrich, The Bermuda Is., p. 119, pl. xi, figs. 3, 4, 1889.

PLATE LXVII. FIGURES 5, 5a, 5b.

Polyps of moderate size, extremely variable in form and height, united into more or less extensive clusters either by slender narrow stolons, or by flat expansions of cœenchyma, or directly, the buds often springing from the basal regions of the column, or even from higher up on the sides, so as to appear furcate or branched; sometimes stolons also arise from above the base. The polyps may be crowded or loosely aggregated; column may be short or long cylindrical; bottle-shaped; jug-shaped; club-shaped; or tall, slender, trumpet-shaped; all these forms often occurring in one cluster (see figs. 5-5b). The wall is soft, but often has dirt, grains of sand, etc., adhering slightly to the surface, except on the upper third or fourth part, which is smoother and naked, so that the surface is usually divisible into two regions; but this difference is not always evident. A constriction sometimes occurs between the two areas (fig. 5).

Tentacles numerous, slender, usually 48 to 52.

Color of column usually olive-green, sometimes bluish above; disk and tentacles pale ochre-yellow, with white specks, sometimes greenish.

Height of longest polyps, in contraction, 18^{mm}; greatest diameter, 3.5 to 5^{mm}; height of short forms, 4 to 6^{mm}; diameter, 4 to 5^{mm}; height of medium polyps, about 10^{mm}; diameter, 3 to 5^{mm}.

At and just below low-tide mark, on the reefs, adhering to stones and dead corals.

Zoanthus dubius Les., op. cit., p. 1817 (?non D. and M.).

PLATE LXVII. FIGURE 9.

A few specimens were obtained on the reefs that appear to agree with this species. The polyps are often slightly clavate and distinctly smaller (about 4^{mm} diam.) than those of *Z. proteus* and *Z. sociatus* and form small open clusters, united by flat stolons. The lower part of the column is covered with sponges and other foreign substances; the upper part is soft and smooth.

Protopalythoa, nom. nov. Type *G. variabilis* Duerden.

Gemmaria Duch. and Mich., Corall. Antill., p. 55, 1860, (non McCreedy, 1859).

Gemmaria McMurich, The Berm. Is., p. 131, 1889; Actinaria Bahama Is., p. 64, 1889. Duerden, Jamaican Actinaria, i, p. 350, 1898.

The name *Gemmaria* having been preoccupied in Hydrozoa, it is necessary to give a new one to this group, if it is to be considered as really distinct from *Palythoa*, from which it seems to differ only in the fact that the zooids are not united together laterally by cœnenchyma, but only by stolons or based expansions. Some species of *Palythoa* are not thus united for more than half their height, or even less, and perhaps future discoveries may show a complete gradation between the two conditions.

The sphincter muscle is single; the mesenteries are microtypic; the mesogléa contains lacunæ; the walls contain grains of sand, etc., making them more or less coriaceous. The zooids are sometimes monœcious; sometimes diœcious.

In renaming this genus I have intentionally assigned a new type, selecting the species which has been most fully described anatomically. The first species named by Duch. and Mich. (*P. Rüsei*) was not figured and was so imperfectly described that it cannot be determined; not even the colors, nor the number of tentacles were given.

The second species (*P. clavata*) is said (1850) to have 30 tentacles, and to have a brown body and violet disk and tentacles. It seems to be very like *P. variabilis*, but the latter has 60 to 80 tentacles, and is larger.

Other closely allied species are *P. isolata* McMur., Bahamas; *P. fusca* Duerden, Jamaica; *P. McMurrichi* Hadd. and Shackl.; *P. Mutuki* H. and S.; *P. Canariensis* H. and Duerd.; *P. Heilprini* Ver. = *G. Rüsei* McM. (non D. & M.), see p. 560. The affinities of *G. brevis* D. and M. are uncertain.

Protopalychtha grandis, sp. nov.

PLATE LXVII. FIGURE 6.

A large species with the polyps united into small divergent clusters by short stolons, furcate at the base, or sometimes isolated; walls thickly encrusted with fine sand. Column in expansion usually clavate, obconic, or long trumpet-shaped, with the basal part tapered and rather narrow; often two to three times as high as broad. Disk broad, cup-shaped or when fully expanded convex or umbrella-shaped, with the borders recurved. Tentacles numerous, about 60 to 66, in two alternating rows, all similar, short, obtuse; outside the tentacles is a circle of marginal papillæ, nearly as large as the tentacles and alternating with the outer row. Sometimes one tentacle (directive), in line with the long axis of the mouth, was larger and lighter colored than the rest.

Color of column usually pale orange, salmon, or buff, under the coat of white sand; disk usually rich orange or orange-brown, sometimes light orange, buff, or ochre-yellow, the tint often varying in the same cluster, its outer part, near the tentacles, darker than the central, and usually with darker radial lines, sometimes tinged with green; lips white or orange; tentacles like disk, but usually a shade paler, often darker at base, but the tentacles may be darker than the disk in pale specimens.

Height of largest polyps, 30 to 36^{mm}; diameter of expanded disk, 12 to 16^{mm}.

On dead *Oculina*, off Bailey Bay, 30 to 40 feet; Harrington Sound, 2 to 6 feet; also in shallow water on the reefs, not common.

Decidedly larger than either of the species hitherto described from the Atlantic.

Palythoa Lamx., Polyp. flex., 1816.

Corticifera Leseur, Journ. Acad. Sci., Philad., i, p. 178, 1817.

This genus differs from *Protopalychtha* only in having the polyps united laterally, to a greater or less extent, by cœnenchyma filled with sand and other foreign substances, so as to form continuous coriaceous crusts, often of great extent.

The mesenteries are microtypical,* as in *Zoanthus*, and usually not very numerous.

* McMurrich, evidently by error, states that they are macrotypical (Actin. Bahama Is., p. 62), but he describes them as microtypical on a later page (p. 66).

Two species of this genus are common and often found together, on the rocks at low-tide, in tide pools, or even in exposed situations, where they are often laid bare by the tide. Both are buff or pale ochre-color and thickly encrusted with whitish sand. The more common is the species described as *Corticifera lutea* by Hertwig and as *C. glareola* by McMurrich. As indicated above (p. 560), neither of these names is correct. The zoöids are decidedly larger and the tentacles (36–38) more numerous than in *P. glareola*. It forms broad encrustations, often one to three feet in diameter, varying in thickness up to one-half an inch or more (10 to 15^{mm}), with the zoöids 6 to 8^{mm} in diameter when expanded, or 6 to 7^{mm} in contraction, and projecting, when fully contracted, only very slightly or not at all above the cœnenchyma, but in partial expansion forming more or less prominent verrucæ, often nearly as high as broad. All these various conditions can often be seen in the same cluster. Pl. lxviii, fig. 7.

This appears to be the earliest described species, *Palythoa mammillosa* (Ellis and Sol., 1780), of which their second species (*ocellata*) was perhaps a synonym, differing only in the state of preservation.

The other Bermuda species, remarkable for the large size of the polyps and the extent to which they are free distally, appears to be undescribed. (*P. grandiflora* V.)

We did not find the real *Palythoa glareola* Les., at Bermuda. It is distinguished mainly by the smaller size of the polyps (diam. 4^{mm} contracted) and the fewer mesenteries and tentacles (24, t. Les.; 28–34 t. Duerd.). Perfect mesenteries about 16–17, often unsymmetrical (t. Duerd.); 17 (t. Les., fig.). Disk violet (t. Les.).

Its appearance and mode of growth are nearly the same as in *P. mammillosa*, but it forms thinner crusts (about 5–8^{mm}), though perhaps of equal extent. It was well described and figured, with anatomical details, by Leseur (op. cit., pp. 178, 184, 185, pl. viii, figs. 6–9, 1817), and more fully, with histology, by Duerden (Jamaican Actinaria, i, p. 365, pl. viii A, fig. 9, pl. xix, figs. 5–7, 1898) as *P. Caribæa* D. and M.

***Palythoa grandiflora*, sp. nov.**

PLATE LXVIII. FIGURE 6.

Zoöids large, often free distally for about half their entire length, and forming clusters (usually of 12 to 24) several inches across. In contraction the zoöids form large, rounded mammillæ, often higher than broad, strongly sulcated longitudinally, the grooves (about 26) converging to the central depression of the summit; sur-

face covered with a firm coat of fine sand. In partial expansion, the summit becomes considerably swollen or turbinate; in full expansion, broad saucer-shaped. Tentacles about 52 to 56 or more, short, subequal, with half as many marginal denticles.

Color buff or light ochre to dark ochre; disk dull orange or brownish yellow, usually marked with radial lines and specks of white; tentacles dull orange, often tipped with white; marginal denticles, flake-white.

Height of zooids, 15 to 20^{mm}; diameter in contraction, 10 to 13^{mm}; disk, in expansion, 14 to 16^{mm}.

This species has larger zooids and much more numerous tentacles than any hitherto described.

It is probably the species described as *Corticifera ocellata* by McMurrich (Bermuda Is., p. 127), but not the original *ocellata*.

As additional species of West Indian *Zoanthi* are likely to occur at the Bermudas, I add, for convenience, the following analytical table, based chiefly on the external characters given in the *original* figures and descriptions, but supplemented in some cases by the observations of later writers (as indicated), and by personal studies. Valuable diagnostic characters are undoubtedly to be derived from anatomical and histological studies, especially from the character of the sphincter muscles and the musculature of the mesenteries. But at present only a few species have been studied in these respects and some of those that have been thus studied have evidently been erroneously identified, so that these characters cannot be used advantageously in this table. Moreover the individual variations in their anatomy, known to be great, have not been sufficiently investigated in any species. The size and form of the sphincter muscles vary according to the degree of contraction and mode of preservation. For such characters reference should be had to the plates of McMurrich and of Duerden. The number of tentacles is equal to that of the mesenteries, but as the latter are added by pairs, bilaterally, next the directives, the number varies considerably, even in polyps that seem adult.*

I do not pretend to vouch for the specific distinctness of all the nominal species included in this table, but they are the forms usually regarded as distinct.

* This mode of increase and the bilateral arrangement of the mesenteries was first definitely described by the present writer in these Transactions, vol. i, pp. 495, 496, 1869, as characteristic of the entire family. Leseur had figured them correctly as early as 1817. Probably the number of *perfect* mesenteries will be found more constant than the total number, but this has seldom been given by writers on this group.

Analytical table of West Indian Species of Zoanthus.

- A.—Tentacles short, subequal, in two alternating series.
 B.—Cœnenchyma mostly in the form of tubular or band-like stolons.
 C.—Tentacles 50 to 60, or more.
 d.—Column usually clavate and pedunculate; stolons mostly tubular; clusters open.
 e.—Greatest diameter of column usually 4 to 5^{mm}; height 25^{mm} or less, column usually bluish green or violaceous distally; prevailing color of disk, green or blue, variegated or radially spotted with brown. *Z. sociatus* Les.
 ee.—Greatest diameter of column 11^{mm}; expanded disk 13–14^{mm}; height of column up to 50^{mm} or more. Prevailing colors of column yellowish or reddish; of disk and tentacles, yellowish, reddish, or red-brown. Test “coriaceous”: “ovaries, 20” (t. Leseur). *Z. Solandri* Les. (type).
 dd.—Column usually nearly cylindrical, not distinctly pedunculate; stolons mostly flat and band-like; clusters close, exposed. Size “one-third smaller than *sociatus*” (t. Les.). *Z. dubius* Les. (type).
 CC.—Tentacles 48–52. Column protean, may be cylindrical, jug-shaped, sub-clavate, and trumpet-shaped in one colony. Stolons variable, mostly narrow. Diameter of column, usually 5 to 6^{mm}; height up to 20^{mm}, mostly less. Prevailing color of disk and tentacles, green. Test with a rough cuticle proximally. *Z. proteus* Ver.
 CCC.—Tentacles about 36. Size large. Column somewhat clavate, but with a wide base. Clusters open. Diameter of column distally about 15^{mm}; its height up to 35^{mm}; diameter of expanded polyp, 20^{mm}; length of tentacles, 2.5^{mm} (t. fig. by Duch. and Mich.). Column greenish distally; a ring of green around the mouth. *Z. flos-marinus* D. and M. (type).
 BB.—Cœnenchyma mostly lamellar or membranous, polyps short, clusters usually rather close.
 f.—Column short, usually obovate, swollen, pedunculate. *Mammillifera* Les.

Tentacles about 52–60.* About 60 mesenteries, of which 27 are perfect and bear ovaries (t. Leseur, p. 184, and pl. viii, fig. 3). Diameter of column, in contraction, about 6^{mm}; in expansion about 7^{mm}; height, 7–8^{mm}. Test “soft and smooth.” Disk greenish; tentacles and column reddish (t. Les.).

Z. auricula (Les.).

* Leseur, on p. 178, Journ. Phil. Acad., i, 1817, gives the number of tentacles as 26–30, but this is evidently an error, probably due to the fact that only one cycle was shown in the drawing. In his remarkably accurate transverse section he shows 61 mesenteries, and also indicates the directives, the inequality of the pairs, and the *bilateral arrangement* of the later pairs,—features that were ignored by later writers for nearly half a century! (See these Trans., i, p. 495.) As the number of tentacles, in this family, corresponds to the mesenteries, it is safe to assume that 52 to 60 are the usual numbers. McMurrich and others have been misled by this error (see McMurrich in Ann. N. York Acad., ix, p. 189, 1876).

ff.—Column cylindrical or subclavate, with a rather stout base.

g.—Tentacles about 50 (t. Les.); 56–62 (t. McMur.). Column short, nearly cylindrical; diameter in contraction, 3–4^{mm}; height, 2–3.5^{mm} (t. McMur.). Disk yellowish, a green circle at base of tentacles; tentacles light brown; mouth rosaceous (t. Les.). Test soft and smooth, but with a cuticle (t. McMur.). Hermaphrodite. *Z. nymphaea* (Les.).

gg.—Polyps larger; column more elongated, cylindrical or only slightly clavate.

h.—Tentacles small and very numerous. Diameter of column, in contraction, 5–6^{mm}; disk, in expansion, 8–9^{mm}; height of column, 10–12^{mm} (t. fig. by D. and M.). Cœnenchyma thick, fleshy. Clusters rather open. *Z. Anduzii* (D. and M.).

hh.—Tentacles about 60. Perfect mesenteries 26–28. Column wall thin, with a cuticle below, carrying foreign matter. Diameter of column, in contraction, about 6^{mm}; of fully expanded disk, 8–10^{mm}; height of column, 4–30^{mm}, average about 13^{mm}. Clusters rather close. Cœnenchyma thin, tough, lamellar. Colors variable; column, pale below, olive-blue above; tentacles usually dark brown, sometimes green or olive; disk usually bright green with paler radial lines, sometimes pale green or yellow, sometimes a dark triangular spot in line with each angle of mouth; peristome pink, bright green, or yellow. Becomes dark green in alcohol (t. Duerd.). Hemaphrodite. Sphincter muscle distinct from that of *Z. nymphaea* (t. Duerd.). *Z. pulchellus* Duerden.

(*M. distans* and *M. pulchellus* (both of D. and M., Supl., 1864), St. Thomas, were originally too imperfectly described, and as intimated by their authors, may be only varieties of *Z. nymphaea*.)

AA.—Tentacles long and slender, recurved, about 60, their length 8^{mm}, as figured. Polyps large, clavate, pedunculate, 40–42^{mm} high; diameter of column distally, in contraction, 8^{mm}; of expanded disk, without tentacles, 10^{mm}. Tentacles blue. *Z. nobilis* D. and M.

(This may be an *Epizoanthus*, which it resembles in the length and slenderness of its tentacles. Its anatomy is unknown.)

ALCYONARIA.

GORGONACEA.

Lists of the Gorgonacea have been published by J. M. Jones, J. D. Dana, Heilprin, and others, but none of them are very complete. Heilprin gives nine species, but two of them are probably mere varieties. The following valid species are in Heilprin's list (Bermuda Is., p. 103).

Gorgonia flabellum Linn. Sea-fan.

Gorgonia acerosa (?) Pallas. Purple sea-plume.

Gorgonia Americana Gmel. (Recorded by Dana.) Sea-plume.

Plexaura flexuosa Lamx. Sea-rod.

This is one of the largest as well as the most common species. It becomes two feet or more broad and often three feet or more high, with a very large main stem, two or three inches in diameter. The branches are furcate with very numerous terminal branchlets, 4 to 6^{mm} in diameter. The calicles are small, round, not crowded, with the borders only very slightly raised or not all so. Color in life, dull dark purple or grayish brown; when dried usually purple-brown, often brownish yellow, or a combination between these colors.

Plexaura homomalla (Esp.) Lamx. Black sea-rod.

Plexaurella crassa (Ellis and Sol.) Lamx. = *multicauda* Heilp. Sea-rod or sea-whip.

See pl. lxix, fig. 4. Remarkable for the very large size and elegance of the polyps, which cannot be retracted; but in life they completely conceal the coral and make it look like a soft branching sponge. The pores are large, open, and close together when dry.

Plexaurella dichotoma (Esp.) Kölliker.

Easily recognized by its long, stout cylindrical or digitate branches, covered with very irregularly shaped pores, which may be narrow-oblong, elliptical, oval, or circular, with the long axis in various directions and with lips only slightly raised or not at all.

The *Gorgonia purpurea* and *G. pseudo-antipathes* of Heilprin's list are indeterminable. The former is probably the purple variety of *Plexaura flexuosa*.

Gorgonia turgida (Ehr.) Verrill, has been recorded from Bermuda by the present writer (Amer. Journ. Sci., xlviii, p. 424, 1869).

Additional Species of Gorgonacea.

Gorgonia citrina Esper., 1794.

Gorgonia citrina Esper, Die Pflanzenth., ii, p. 129, pl. xxxviii, figs. 1, 2, 1794.

Gorgonia (Pterogorgia) citrina Dana, Zoöph., 1846.

Xiphigorgia citrina Verrill, Bull. Mus. Comp. Zoöl., i, p. 33, 1864.

Several specimens of this small, flat-branched species were obtained by our party in 1898. Both varieties, yellow and purple, occur but most examples are tinged with both these colors.

Gorgonia setosa Linn. Purple sea-plume.

A single perfect specimen of this fine species is in our collection. Others, of large size, but imperfect, were seen in local collections. It may be only a variety of *G. acerosa* Pallas.

Muricea muricata (Pallas) Verrill.

Gorgonia muricata Pallas, Elench. Zoöph., p. 198, 1766. Ellis and Sol., 1780.

Muricea spicifera Lamx., Exp. Method., pl. 71, figs. 1, 2, 1821.

Muricea muricata Verrill, Amer. Journ. Sci., xlv, p. 411, 1868.

Numerous fine specimens of this species were obtained, in 1898, by the Yale party, on a small reef in Bailey Bay, a few feet below low-tide, by diving. It completely covered one small reef. It was also found on the reefs in Castle Harbor, but only sparingly. In life, its color is yellowish brown to ochre-yellow, with beautiful translucent, white or buff, elongated polyps, which become so exsert in expansion that they entirely conceal the coral, their length equal to the diameter of the branches. When dried the color is pale buff or ochre, sometimes tinged with rust-brown. The lower lip of the calices projects strongly and the whole surface is very spiculate, some of the superficial spicules being very large and irregularly fusiform.

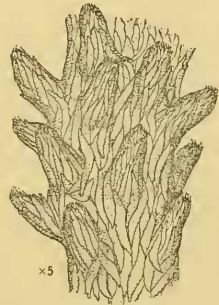


Figure 1.—*Muricea muricata.* x5

Eunicea ramulosa Ehr., 1834.

Gorgonia spicifera Dana, Zoöph., 1846.

A few specimens of this were seen in local collections, but none were taken by our party. The branches are slender and arise laterally or pinnately from the main stems.

Eunicea grandis, sp. nov.

PLATE LXIX. FIGURES 3, 3a.

A very large species, with long, round, thick, digitate or furcate, rigid branches, which taper but little distally and usually lie somewhat in one plane, thus forming corals one to two feet broad and sometimes nearly three feet high. Axis nearly cylindrical, dark brown or black, osseous at base. Cœnenchyma very thick and hard, filled with fusiform spicules of moderate size.

Calicles, in dried specimens, not much elevated, usually forming low convex verrucæ, with a small, terminal, indistinctly eight-lobed aperture; sometimes with a large round opening having the edges a little elevated.

Color when dried brownish black, dark umber-brown, or yellowish brown. In life umber-brown or sepia-brown, sometimes tinged with purplish or yellow.

The very large exsert zoïds expand freely in confinement and then the calicles are more prominent, and evidently 8-lobed. The expanded zoïds are swollen, somewhat translucent, dark russet-brown or yellowish brown, paler than the cœnenchyma, with a white line on the outside of tentacles, due to spicules; mouth bordered with white. The tentacles are much stiffened by spicules and contract slowly.

Diameter of main stalk often 2 to 3 inches, at base; diameter of digitate branches about .50 to .75 inch (12 to 18^{mm} or more), their length 6 to 12 inches.

Not uncommon in 6 to 20 feet, on the reefs.

This species is similar to *E. Rousseaui* Edw., in size and appearance, but that species has a prominent lower lip to the large calicles. Our species appears to be a larger, much stouter and more branched form.

Eunicea Tourneforti Edw., Corall., i, p. 150, 1857.

? *Gorgonia madrepora* Dana, Zoöph., p. 671, 1846.

PLATE LXIX. FIGURES 2, 2a, 2b.

This species grows in forms similar to the last, but it is smaller, with the branchlets about 7 to 12^{mm} in diameter. The calicles are more prominent, oblique, with the aperture on the upper side and the lower lip prolonged, as in the calicles of madrepores.

Color dark umber-brown or black when dried; dark brown or sepia-color in life.

Eunicea Rousseaui M. Edw. and Haime.

Corallieres, vol. i, p. 151, 1857. Verrill, Bull. Mus. Comp. Zoöl., i, p. 36, 1864.

Gorgonia pseudo-antipathes (pars) Dana, Zoöph. (non Esper).

This is also a large species with stout, forked, digitate branches, nearly as in the last, but larger. The calicles are large, rounded, somewhat elevated, directed obliquely upward, and with the lower lip a little prolonged.

Diameter of digitate branchlets 12 to 18^{mm}; their length, 150 to 300^{mm} (6 to 12 inches).

Color when dried, dark umber-brown or blackish.

Only a few specimens were obtained.

HYDROZOA.

This group has been studied but little at the Bermudas. Mr. J. Walter Fewkes* has published a descriptive list of 26 free Hydrozoa and 4 Ctenophora observed by him during a brief visit to Bermuda. Some of these were new species, but several are known from the New England coast and farther south.

Our party collected very few free forms and added to the list only the common *Porpita Linnaeana*.

Attached hydroids are not numerous, either in species or individuals, only about 6 species of sertularians, 3 campanularians, one plumularian, and one tubularian having been collected by us.

The tubularian is *Pennaria tiarella*, found also on the American coast northward to Cape Cod. All the sertularians appear to be well known West Indian species.

The most common sertularian appears to be *Sertulariella Gayi*. It was taken with gonothecæ.

All the numerous specimens of *Millepora* seen by us could be referred to the common polymorphous species, *M. alcicornis*, though *M. ramosa* has been recorded from there by Quelch (Voy. Challenger, Narrative, i, p. 146, note).

* On a few Medusæ from the Bermudas, Bull. Mus. Comp. Zoöl., vol. xi, pp. 79-90, pl. xi, No. 3, 1883.

EXPLANATION OF PLATES.

PLATE LXVII.

- Figure 1.—*Plesiastrea Goodei*, sp. nov. Group of calicles. $\times 4$.
 Figure 2.—*Aiptasia tagetes*. $\times 1\frac{1}{2}$.
 Figure 3.—*Lebrunia Dance*. One of the actinobranchs. $\frac{1}{2}$.
 Figure 4.—*Bunodeopsis globulifera*, sp. nov. $\times 2$.
 Figure 5.—*Zoanthus proteus*, sp. nov. Two of the more elongated polyps. $\times 2$.
 Figure 5a.—The same. Group of polyps from the same specimen as 5.
 Figure 5b.—The same. Short polyps from the same colony.
 Figure 6.—*Protopalylthoa grandis*, sp. nov. $\times 2$.
 Figure 7.—*Actinia Bermudensis* Ver. About natural size.
 Figure 8.—*Madracis decactis* Lym. Group of calicles. $\times 6$.
 Figure 9.—*Zoanthus dubius*. Base is overgrown with sponge. $\times 2$.
 Figure 10.—*Madracis decactis* Lym. Group of living polyps, enlarged about 10 times.

PLATE LXVIII.

- Figure 1.—*Actinactis flosculifera*. Side view. $\times 1\frac{1}{2}$. *b*. Three of the pseudo-fronds, more enlarged.
 Figure 2.—*Phellia rufa*, sp. nov. $\times 1\frac{1}{2}$.
 Figure 3.—*Aiptasia annulata*. Three tentacles of different cycles, much enlarged.
 Figure 4.—*Actinoides pallida*; *a*, fully expanded; *b*, partially expanded; *c*, one of the tentacles, inner surface, more enlarged.
 Figure 5.—*Actinotryx Sancti-Thome*. Oblique view; enlarged about $1\frac{1}{2}$.
 Figure 6.—*Palythoa grandiflora*, sp. nov. Polyps contracted. Cluster, natural size. Photographed from a specimen in formalin.
 Figure 7.—*Palythoa mammillosa*. Part of a cluster. Some of the polyps are more or less expanded, others are entirely retracted. Natural size. Photographed from a specimen preserved in formalin.

PLATE LXIX.

- Figure 1.—*Lebrunia Dance*. Oral side. About natural size.
 Figure 2.—*Eunicea Tourneforti*. Side view of part of a branch. $\times 3$.
 Figure 2a.—The same. Section of branch. $\times 3$.
 Figure 2b.—The same. Portion of a section, more enlarged, to show spicules.
 Figure 3.—*Eunicea grandis* Ver., sp. nov. Part of branch. $\times 3$.
 Figure 3a.—The same. Section of a branch. $\times 3$.
 Figure 4.—*Plexaura crassa*. Surface of a part of a dried branch to show the large open calicles. $\times 3$.